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ABSTRACT

The booklet considers the nature of creativity in children and examines classroom implications. Among the topics addressed are the following: theories about creativity; research; developments in brain research; the creative process; creative problem solving; the Structure of Intellect Problem Solving (SIPS) model; a rationale for creativity in the curriculum; creative development; factors contributing to creativity; recognizing creative potential; traits of creative persons; encouraging creative potential; blocks to creativity; and current approaches to the development of creativity (including synectics, bionics, sociodrama as a problem solving approach, lateral thinking, and creative dramatics). A final section lists 52 methods, techniques, and educational programs for stimulating creativity. (CL)

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CREATIVE THINKING AND PROBLEM SOLVING

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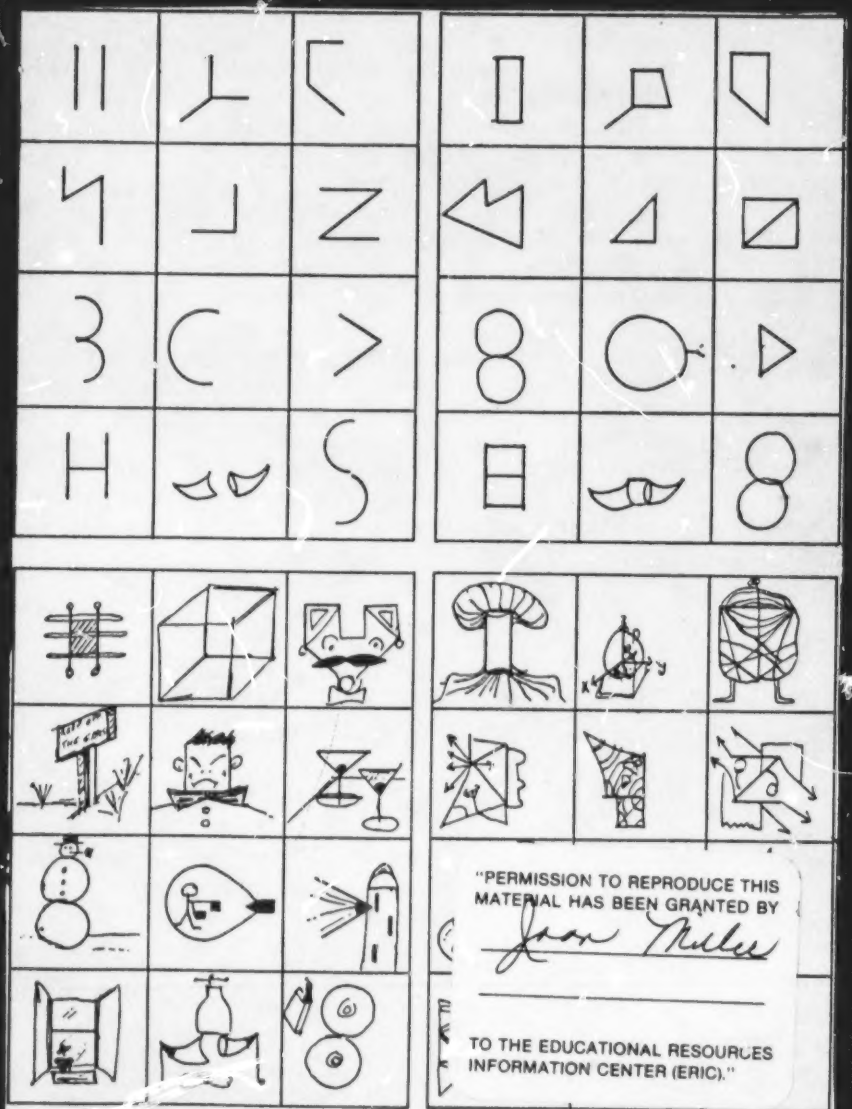
WE BELIEVE THAT FOR THE FUTURE THE PATHS TO EXCELLENCE IN ALL OUR UNDERTAKINGS WILL REQUIRE A GREATER KNOWLEDGE OF CREATIVITY AND A FAR GREATER USE OF THE PRINCIPLES OF CREATIVE PROBLEM SOLVING. IN THE WORDS OF ARNOLD TOYNBEE, "AMERICA MUST TREASURE AND FOSTER ALL THE CREATIVE ABILITY SHE HAS IN HER".

THE PURSUIT OF EXCELLENCE: EDUCATION AND THE FUTURE OF AMERICA, ROCKEFELLER REPORT



Drawing-Completion Test, devised by Kate Franck, required that subjects elaborate on the simple figures at top left. At top right is a typical response of a subject chosen at random. At bottom left and bottom right are the responses of creative individuals.

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The materials in this publication have been written by Grace Lacy, formerly in the Office of Urban School Services, New York State Education Department. The handbook includes both original material written specifically for workshops held by the Department for personnel in New York City, but also draw from other publications. Appreciation is expressed to the original authors for all materials that have been reproduced or adapted.

Readers are encouraged to refer to the original publications wherever possible for full treatment of the subject matter.

The material is in draft form and will be revised and refined as reactions are received from workshop participants.

1979 Reprint

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JUN 2 1980

CREATIVE THINKING AND PROBLEM SOLVING: SOME IMPLICATIONS FOR EDUCATION

Creativity is a very complex subject which has proven difficult for philosophers and psychologists to study. The difficulty stems from our problems in understanding the nature and origin of creativity. As a result, the literature on the topic contains many different theories and definitions, no one of which seems to satisfy everyone. However, since man's need for creativity has never been so great, it is now time for educators to find new and better ways to foster this trait. Some brief insights into the nature of creativity, some research findings and approaches to the development of creativity, and extensive listings of literature on the topic as well as materials created to assist educators in this area are provided in this paper to help educators better understand the curricular implications of creative development.

WHAT IS CREATIVITY?

"Creativity is considered the process of recombining known elements to produce more valuable (satisfying) ideas than previously existed in the mind of the thinker". (Parnes 1976). We can gain some insight into the nature of creativity by using the analogy of the kaliedoscope, that instrument which is lined with mirrors and which contains loose particles of colored material. When the one looks into the kaliedoscope and manipulates the drum an infinite variety of different patterns can be created. If one adds even just one more particle, a large quantity of new patterns are possible. This analogy points out that creativity depends on knowledge; the more bits of information a person has the more varieties of ideas s/he is likely to produce -- if s/he has been trained to use creative capacities.

SOME THEORIES ABOUT CREATIVITY AND THEIR IMPLICATIONS FOR SCHOOL PROGRAMS

There are many different theories about creativity but the two most widely held are:

1 That creativity lies within the domain of intelligence although it extends beyond it and is also the result of personality traits such as curiosity, openness to experience, a willingness to take risks and a tolerance for ambiguity. J.P. Guilford, noted psychologist and researcher in the area of the intellect, believes that creativity is significantly determined genetically and his aim is to promote the early identification of creative potential and consequent training to enhance this quality.

2 Sid Parnes of the Creative Education Foundation favors an environmental thesis -- that is he believes that all persons have some amount of creativity and that this quality can be developed in all persons though education.

In the past it was thought by most people that creativity was a rare quality inherited by only a few and that creative acts were largely the result of chance. Today that viewpoint is swinging toward the position long held by art educators such as Viktor Lowenfeld, that all persons have some amount of creativity and that creativity can be enhanced by proper educational procedures. This changing point of view brings about pressures for a serious overhaul of school curriculums to provide for more opportunities for creative development. But a thorough understanding of the nature of creativity is necessary before such changes can be made. Simply adding more traditional art classes, dance groups and glee clubs is not the answer.

The present concern for creativity reaches significantly beyond our "arts and crafts" conception of creativity. It builds on the fundamental premise that children and adults can study and learn creatively in any area of the curriculum. Creativity is a process, a way of teaching and learning -- not just a special art project or unusual composition. Creativity has to do with the total climate for learning. It involves not only the strategies, techniques and activities, but also the attitudes and feelings of teachers. These are the effective dimensions for creativity, learning, and teaching and they must be affectively integrated with the cognitive (intellectual) dimensions of learning in order for creativity to be fostered.

The almost exclusive dependence on the Thorndike-Skinner "stimulus-response" approach to learning in American schools totally neglects important individual differences and tends to suppress creativity. Divergent thought or activity in schools has tended to be frowned upon and there has been emphasis on conformity at the expense of creative independence. Of course, it is recognized that schools are subject to many competing pressures, but it is now evident that there needs to be a balance between pressures for socialization and opportunities for creativity.

RESEARCH IN CREATIVITY

Business, industry and the scientific community have long been aware of the need for increased creativity, for they are aware that logic, convergent and vertical thinking alone cannot provide enough solutions for society's increasing burden of seemingly unsolvable problems and that new approaches to problem solving are also needed. Moreover, they are aware that the computer is now at the stage where it can take over much of this kind of thinking and can do it better, faster and more economically.

Pressures for improved production and new problem solution in industry provided the immediate economic motive and so in the early 50s a virtual explosion of research in the area of creativity began which has greatly increased knowledge of this trait. A brief review of the highlights of this research is given below.

- J.P. Guilford, did an Aptitudes Research Project Study which came to the conclusion that whatever the essential mental functions of creative thinkers are, they shared to some extent by all mankind.

- E. Paul Torrance did research on the creative qualities of children and of teachers who tried to teach creatively.

Getzels and Jackson did a very famous study which found little correlation between creative abiiity and intelligence as measured by the IQ. (It is possible to have a very high IQ and be low in creativity. However, below an IQ of 125 it is not likely that high creativity can be found).

Calvin Taylor of the University of Utah developed a biographical inventory for indicating creative promise in individuals in the sciences.

Ann Roe did a study of the characteristic traits of eminent men in the sciences who have made great contributions to society.

Alex Osborn, originally in advertising, anxious to stimulate more creative thinking in business and government wrote what is now a world famous book, called Applied Imagination, in which he set down certain principles for creative problem solving. He also established the Creative Education Foundation at the University of Buffalo as well as the Journal of Creative Behavior, the only periodical exclusively devoted to creativity.

This Foundation was first used by business and industry as a means for training personnel in creative problem solving, to create new products and to encourage creative output in industry. Only later did some educators become interested in this venture.

The Richardson Foundation established a creativity award on the grounds that if you want creativity you must reward it.

These and other studies have enlarged our knowledge of creativity and made educators growingly aware of the importance of creative development in youth and society.

DEVELOPMENT IN BRAIN RESEARCH

During the same period, and to the present, extensive brain research has provided important new insights into the nature and process of learning which have profound signficance for education. This knowledge of brain research is new, while many of the school's educational traditions are old and date from the time when the brain was nearly a total mystery. One must be prepared to set aside a good deal of educational psychology that predated brain research. The human brain was not designed for schools, nor were schools designed to fit the brain. For example. some doubtful beliefs about the brain on which much educational practice is based are:

1 The "tabula rasa" theory, which holds that the brain is a blank on which instruction can be inscribed. The belief is that if X is taught X will be learned; despite mountains of evidence to the contrary. Newer perception theory tells us that the brain is aggressive and that each brain is highly unique and each seeks out only what it needs to make sense out of its environment -- as it perceives the reality of that environment. This means that group instruction is grossly brain-incompatible.

2 The brain is not seen as the stimulus-response device presented in various behavioral theories. It admits only what it decides to admit and each brain processes what it does admit in its own individual way. What is admitted, may be sharply different from what the teacher intended.

The processing depends little on what or how the teacher has presented, and greatly on the total previous stored experienced in that particular brain. Thus the standard lecture, recitation and discussion that takes place in most classrooms cannot be expected to produce much learning in any reliable way.

3 The neocortex of the brain does not produce well under pressure. When students see classroom activities as threatening, the neocortex slows down on processing.

4 Young students must talk to learn well as much brain activity is language related, yet teachers continue to do most of the talking.

5 Educators are obsessed by logic -- a tight step by step, ordered sequential (linear) effort in verbal or symbolic form. But according to research the human brain has little use for logic of this kind. The brain is a computer but far more analog than digital. It works by precision but probabalistically, by great numbers of rough, or vague approximations.

6 Schools tend to teach only half of the child by concentrating mainly on cognitive left brain functions. The right brain which deals with affect, spatiovisual relationships, fantasy, imagination, all of which have to do with creativity and adjusting intelligently to an increasing visual and multisensory environment is often ignored.*

These are only six points about the brain and learning implied by research which suggest that major reforms are needed in the way we organize schools if they are to become brain-compatible.

Programs should be based on some brain-based theory of human learning. "Proster theory" is the first brain-based theory which is highly congruent with modern technical knowledge of the human brain. It differs sharply from the "rat psychology" of the stimulus-response theory so predominantly used in schools. The brain works by seeing patterns and this is why the linear-logic approach so often fails in classrooms.

Proster theory defines learning as the acquisition of useful patterns and programs. No teacher can possibly teach the huge number of programs to be learned. The teacher must move from being the instrument of instruction to directing the learning process by arranging the environment so students can learn from materials, devices and tutoring largely on a self-service basis. *

This approach requires that the teachers understand the various processes of learning and thinking as well as how to create useful programs so that the brain can extract meaningful patterns from the confusion of the environment.

HOW DOES CREATIVITY HAPPEN? THE CREATIVE PROCESS

A great deal of research has been done on the lives of creative persons such as inventors scientists, artists, writers and others who have made notable contributions to society. In general, the creative process they have all gone through, whether they be scientists, writers, artists or others, is the same.

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*" The New Brain Concept of Learning," Leslie, Hart , in Phi Delta Kappan LIX Feb. 1978 pp 393-96

This process consists of roughly the following steps:

Problem awareness: The individual becomes aware of a lack of satisfaction with the existing state of affairs and feels the need to seek resolution of the problem which may be ill-defined or just a "mess" of dissatisfaction.

Problem definition: The individual then feels the need to seek resolution of the problem by finding out exactly what it is, and stating it in such a way that s/he can take some action to solve it.

Incubation: During this period the individual may read, research, discuss, study think, imagine, fantasize, collect data, (including his feelings), about the situation. There is much affect and right brain activity at this stage. The individual may give up active work on the problem but his/her brain is programmed to going on struggling with it.

Illumination: This is the "Aha moment" when a solution pops into the mind, often in a flash of insight as a result of all the mental activity during the incubation period.

Evaluation: At this stage critical thinking enters the picture as the individual judges his/her one or more answers and judges the validity of the possible solutions. This process involves a shift in attitude and behavior from that which was characteristic in the initial stages of the creative process. Initially, criticsm may have been absent for the most part, but now the imagination must submit its work to the scrutiny of the critical faculties. In addition to being the creator the individual now becomes the audience as well. This step is essential for the individual can think up all kinds of creative ideas but unless s/he can communicate them in a way acceptable to others they have no significance as creative contributions. This is one reason why verbal ability is an important trait for creators to have.

CREATIVE PROBLEM SOLVING: HOW IS IT DIFFERENT THAN OTHER KINDS OF PROBLEM SOLVING?

When the average person thinks of creativity he thinks of it as an esoteric quality confined to the creation of artistic products. But to live is to have problems, and the incorporation of creativity into problem solving enables man to better solve the everyday problems of life as well to make great cultural contributions.

Creative problem solving is a process for approaching a problem in an imaginative way resulting in effective action. In CPS the emphasis is on building up alternatives by searching for a variety of choices at each step of the problem solving process which bears remarkable resemblance to the creative process. Dewey claimed it was the same thing.

The Creative Education Foundation has created a 5-step process for creative problem solving which is described below:

1 Fact Finding: This is focusing in on the situation, acquiring data to help gain a better understanding of what is going on in the situation at hand.

2 Problem Finding is a search to find out what is the real challenge. Redefinition of the problem at this point helps us to look at it from different angles and in new perspectives.

3 Idea Finding encourages looking with imagination in many directions for what might be possible solutions. This stage stresses quantity of ideas and helps build one idea from another.

4 Solution Finding is the period when the various ideas are judged and evaluated.

5 Acceptance Finding forces consideration of why or how an idea might succeed or fail and allows for altering solutions before putting one of them to use.

The CPS approach offers a process for using creative capacity in solving problems. While CPS cannot insure success it increases the probability of success in everyday concerns. The process can be used with all types of problems -- "people" or "thing" problems, scientific, technical or social problems.

The process involves certain principles of: deferred judgment , use of imagination, it involves feelings and concerns, seeks quantity of idea production to encourage quality ideas, encourages obtaining a wide range of data, improved problem definition, a search for alternatives , avoidance of premature closure, use of principles to improve ideas such as magnification, minification, rearranging, redesign; use of forced relationships, bionics, sensory awareness, free wheeling, courting of new perspectives, transfer, critical judgement of solutions and development of a plan of action for implementing ideas.

Further insight into the CPS approach can be gained by reading Scratching the Surface of Creative Problem Solving by Ruth Knoller, D.O.K. Publishers 1977, and Sid Parnes, Guide to Creative Action, Scribner and Sons, 1977.

THE SIPS MODEL

We can define creative thinking in the most definite way in relation to the theoretical models. Guilford places it in the divergent production slab of the SOI and in the category of transformation. Guilford has put the problem solving operations of preparation, incubation, illumination and verification in the SIPS (Structure of Intellect Problem Solving) model. Underlying everything in this model is the memory store. Events involve input from the environment that include feelings which pass through a filtering process in the lower brain which selects actively. This is the process of attention. Certain biases and preconceptions in the memory store may prevent us from becoming aware of certain problems.

Information that gets through the gate instigates the operation of cognition (awareness that a problem exists and the comprehension of the nature of the problem). As the individual searches for a solution divergent production comes into play. Then the evaluation of the solution takes place. Divergent thinking in structuring the problem and creative activities take place wherever transformations occur and also play a role in structuring the problem. Guilford recommends the following strategies for problem solving

.Broaden the problem-Instead of asking, How can I build a better mousetrap? ask, How can I get rid of mice?

. Break problems into subproblems.

. Ask questions about it. These prod the brain into activity.

. Suspend judgment in considering possible solutions.

. Extend effort - Try to think of many solutions.

. Attribute listing - Reclassifying things to make them more generally useful.

. Forced relationships - Relate things to get new answers (e.g. wheelchair, clock radio, forced relationship resulted in new products).

. Brainstorm to produce quantity of ideas to get quality as a by-product.

. Morphological analysis.

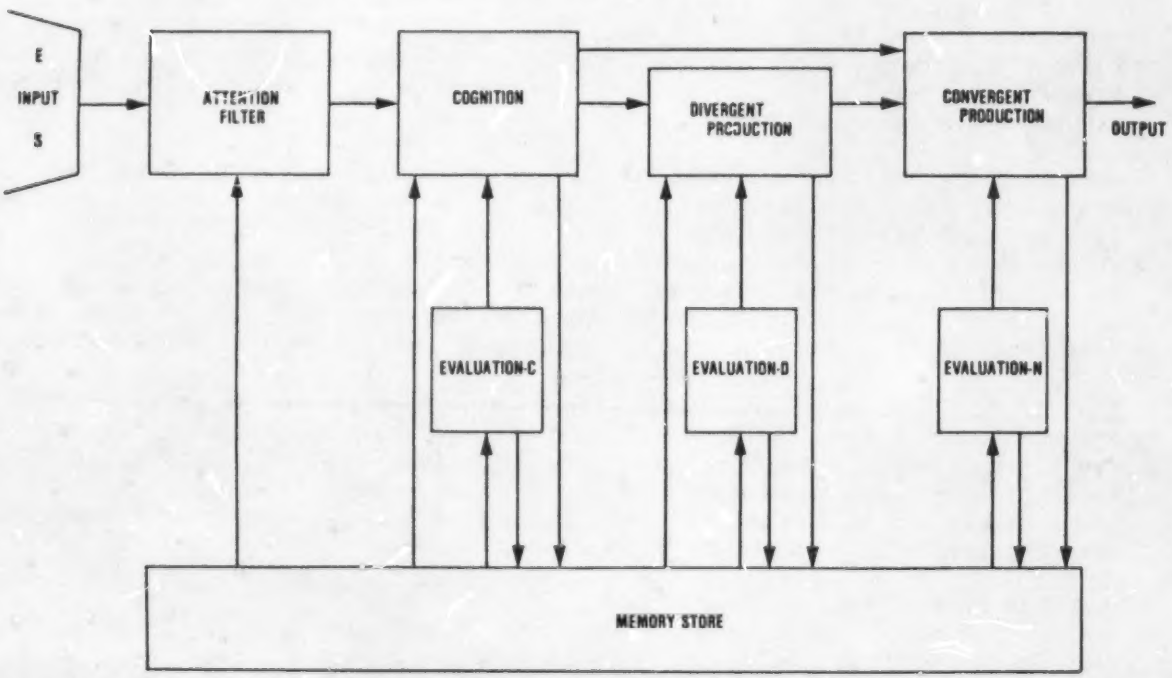
. Try incubating - Hold off actual work on the problem for a time.

. Altered states of consciousness - Meditation and dreamlike states during relaxation.

. Criteria evaluation - Draw up a checklist of requirements for the product.

. Induce transformation through the Osborn method of adapting, modifying and so on.

THE SIPS CREATIVE THINKING MODEL



From Way Beyond the I.Q. , J.P. Guilford, The Creative Education Foundation

A RATIONALE FOR CREATIVITY IN THE CURRICULUM

In a stable culture the job of the schools is to hand down the culture and skills useful for living in it. The curriculum can consist of a set body of information and the rules and skills can be taught largely by rote. In such cultures the pupil is viewed as having a set capacity for absorbing knowledge. S/he may be a pint container, a quart, or have a gallon capacity.

In a modern technological society, where the only constant is exponential change, schools must teach those parts of the culture and skills that are still useful, but the aims of education must be enlarged to enable the child to become a life-long learner and creative problem solver in order to help him cope with and survive in the swirling seas of change. Now the learner is not viewed as having a set capacity, but as a "becoming" human being with the potential to develop into something better.

In such a society the gifted and creative are sought out and nurtured, for it is on the backs of these highly creative few -- (as a result of their inventions creations, new ideas and images of the future) that civilization progresses. Guilford points out that "in the race between man's survival and catastrophe, the future of our civilization depends on creative education". Our need for leaders with vision and imagination is well recognized, as is the enormous economic value of the new ideas of gifted people.

Moreover, the Second Industrial Revolution is rapidly coming upon us. Just as the first Industrial Revolution made man's muscles relatively useless, the second one is expected to make man's brain relatively useless; for the kind of vertical, linear thinking he now mainly does can be done by computers more rapidly and efficiently. To create the new economic order that will be necessary for survival, will require creative thinking of an unusual order and speed. Indeed the main economic value of the brain left would lie in its ability to think creatively. To meet this demand schools cannot rely on occasional isolated courses in creative thinking, but must seriously overhaul the entire curriculum to provide improved opportunities for creative development.

Moreover, it is now realized that creative thinking not only results in invention, discovery, scientific theories and improved products and arts, but is is important for personality development and mental health. Repression of creativity strikes at the roots of satisfaction in living and can result in mental illness. Creative development also contributes importantly to the acquisition of information and may ultimately be demonstrated to be as important as memory and similar intellectual functions for it is essential to the application of knowledge to daily problems.

Invariably, the creative individual can think up more interesting things to do and thus avoid boredom. Creative people are also more self-confident because they can think up ways to adapt to change and solve problems. In addition, creativity leads to more open-minded acceptance of ideas and of people that are different than oneself and this promotes better human relations. Unhappiness results whenever creativity is thwarted as it is in many school programs.

CREATIVE DEVELOPMENT

Both Gowan (1972) and Torrance (1978) have discussed the developmental aspects of creativity. Gowan regarded creative development as progressing in discrete stages (after the models of Freud, Piaget and Erikson) and Torrance perceived creative

development as continuous. Gowan feels that the person passes through three stages; latency, identity and creativity but each time at a higher level. Stages 3 (ages 4-6) 6, (ages 18-20) and stage 9 (the later years of adult life) with the earliest critical to the development of the later periods. He attaches much importance to the preconscious accessibility for creativity to occur. He advises that an abundance of "love" and accessibility to the preconscious are necessary for high level creativity to occur.

Torrance believes creative development is continuous with temporary declines at ages 5, 9, 13 and 17. The worst decline takes place at age 9 when the pressures of school and society for conformance cause stress.

For both Gowan and Torrance, the pre-school years are creative times, and as social pressures grow some creativity is lost. To prevent these declines both suggest that the elementary school years be filled with stimulating opportunities for creative activities and achievement. Affectionate relations should be re-enforced as well as circumstances to make the preconscious accessible. Stress for greater productivity should be reduced. The child should have some time free from pressure to dream, fantasize, reflect and play with ideas.

According to the research of the Creative Education Foundation:

1 Creative imagination can be deliberately developed.

2. Creative problem solving courses can measurably improve the ability of students of average intelligence to produce good ideas, the criteria of the quality being uniqueness and usefulness.

3. A systematic course of instruction in applied imagination can also produce significant gains in personality traits such as confidence, initiative, and leadership potential.

This research indicates that the gap between an individual's innate creative talent and his lesser actual creative output can be narrowed by deliberate eduction in creative thinking.

FACTORS THAT CONTRIBUTE TO CREATIVITY

To teach for creativity we need not only to understand the creative problem solving process but also the traits and factors that contribute to creativity so they can be enhanced in students. Among these are:

- Sensitivity to problems: Creative persons are usually sensitive to what they see, hear and touch, and have a sensitive awareness of people and their problems.

- Children should be stimulated to use all of their senses in becoming aware of the environment.

- Fluency of ideas is another attribute of the creative person. He can generate a great many ideas on a topic. This quality can also be enhanced through brainstorming, pressing for quantity of ideas, encouragement of divergent thinking.

- Flexibility: Creative persons readily adapt and adjust to new situations. Children can be helped to develop flexibility by helping them to look at problems in new ways and generating many alternative solutions to problems.

- Redefinition-the ability to redefine and rearrange. A creative person tends to change the functions of the materials he uses. A piece of steel wool might become a puppet's beard. Assignments should contain many opportunities for redesigning and combining and transfer.

- Analysis-The ability to arrive at details after a study of the whole.

- Synthesis- A meaningful combination of several elements into a pleasing whole. Both these higher level thought processes should be stressed especially for the gifted.

- Coherence of organization-Organiztion of elements into pleasing wholes.

- Imagination-An activity of the mind that produces new ideas or insights. Imagination should be stimulated and encouraged.

HOW CAN WE RECOGNIZE CREATIVE POTENTIAL?

Torrance, Taylor, Guilford and others urge that educators attempt to locate creative potential early so that it will not be stamped out by repressive schooling practices and so that it can be nurtured, but testing for creativity is not an easy matter. It cannot be measured by intellignece tests and it depends upon many important qualities we do not as yet know how to measure objectively. Schools stress mainly those qualities we do know how to measure, even though they may not be the most important ones.

Through factor analysis Guilford and others have isolated some of the different kinds of ability inherent in creativity such as fluency, flexibility, sensitivity to problems and originality, and tests have been devised to measure these qualities.

For the measurement of originality a Plot Titles Test has been devised which presents a short story and the examinee is told to list as many titles as he can for the story. One story is about a missionary who has been captured by cannibals inAfrica. He is in the pot and about to be boiled when a princess of the tribe obtains a promise for his release if he will become her mate. He refuses and is boiled to death. In scoring the test responses are separated into nonclever and clever responses. A few sample responses are given below:

Nonclever responses (appropriate but commonplace):

- Defeat of a Princess
- Eaten by Savages
- The African Missionary

Clever responses

- Goil or Boil
- A Mate Worse Than Death
- He Left a Dish For a Pot

Tests for ideational fluency involve such tasks as listing as many uses as possible for a brick. Responses that provide unusual uses for the brick (such as grinding it up to make powder for paint) or using it for feet for a snowman score higher than do more ordinary uses for bricks such as using them to build a wall or house.

A test for figure redefinition(another creative ability) is called Hidden Figures in which certain lines in the figures must function differently when they become parts of a new figure.

Torrance has also devised various teats for creativity, many of which are non-verbal and involve the completion of incomplete figures. Other tests involve associational fluency and the ability to see analogies. Further information on tests for creativity will be found in the attached bibliography.

TRAITS OF THE CREATIVE PERSONS

Another way of identifying the creative person is through looking for traits associated with this quality. According to various research and biographical studies, creative individuals tend to have:

- More fantasies and more ability to play with ideas.
- More problem sensitivity and more tolerance for ambiguity.
- Effective questioning ability.
- More curiousity and are open to the environment.
- A tendency to strive for more comprehensive answers, solutions and products.
- Superior verbal ability.
- A resistance to idea reduction, they like to explore the full impact of ideas.
- Perseverance with problems.
- More originality.
- Ability to make good intuitive decisions on the basis of incomplete information.
- Ability to make richer syntheses of information.
- An inquiring mind.
- A need for variety and autonomy.
- Resistance to premature closure of problems - but persistence in finding eventual closure.
- A need to improve currently accepted orders and systems.
- High energy and work output through disciplined work habits.
- Willingness to take risks when through his/her own efforts s/he can make a difference in the odds.
- An intense commitment to their work.
- The courage to be independent and nonconforming at times when a point or policy is at stake.
- A tendency to like ideas more than people although gifted persons are not antisocial. Indeed they often have deep social concerns.

WHAT CAN EDUCATORS DO TO ENCOURAGE CREATIVE POTENTIAL?

Teachers must play a key role in developing programs for creative development. They must be involved in the instructional design of programs. The development of creativity cannot just depend on last minute spontaneous actions or instructional aids. Instructional design involves concern for systematic planning and frequently begins with a general model of the instructional process and relies on the best of learning theory as incorporated in such models as that of Bloom, Guilford and Williams. It can also greatly benefit from concepts provided by Torrance, Taylor, Osborn, Renzulli and others who research in the field.

To effectively create adequate instructional designs to promote creativity the teacher must know about the creative process and know how to promote it as well as how to provide a classroom atmosphere conducive to creativity. S/he must also know how to create the kind of stimulating learning environment where creativity can occur. She must be adept at removing blocks to creativity, and creative activities must be effectively integrated with the cognitive dimensions of learning in order for creativity to be fostered.

Administrators must set the stage so that teachers can feel free to create such programs. This may appear difficult in the face of the "back to basics" movement and the general lack of understanding of newer learning theory by many conventional teachers and an uninformed public. However, teacher education and education of the community regarding the rationale for these new programs are also necessary. The educator must realize that:

- The abilities involved in being creative are universal and that this quality can be increased by training and that it is the schools legitimate function to provide such training.

- That creativity is manifested early in the life cycle and its development depends upon experiencing the social and physical world and the values of the cultural environment.

- Some of what is recommended for the development of creativity has much in common with such movements as open education, humanistic education , individualization of instruction, process education and the arts in general education.

- It is necessary to learn to recognize and develop creative potential. It is often difficult for the conventional teacher to recognize and accept creativity in children since creative children tend to be independent in nature bent on following their own interests rather than the desires of the teacher.

- Excessive pressures for conformity can stifle creativity. A balance must be struck between education for socialization and development of creativity.

- Educators should not equate creativity only with high IQ children. However, Gowan points out that if the aim is to maximize the number of creative individuals, the intellectually gifted offer an easily identifiable pool of potential creativity. They also usually have the necessary verbal ability to be able to communicate their creative ideas well. He also points out that more creative people can be found by improved methods of locating them.

He cites the example of placer mining which requires only high grade ore leached from rocks. With newer improved mining methods much lower grade ore can be profitably used.

. Teaching strategies that involve discovery and invention promote creative thinking as long as they involve something new to the child. His discovery need not be a totally new idea. This type training can result in later years in genuine original contributions to the culture.

- It is necessary to be alert to notice new ideas proposed by children and to encourage them to continue development of their creative talents.
- Teach principles for creative problem solving as recommended by Parnes and Osborn.
- Inform oneself of the materials useful for promoting creativity but beware of practicing creative activities in isolation from meaningful content and problems.
- Make children sensitive to the environment through multisensory activities.
- Teach children how to test for the worth of new ideas and help them develop tolerance for new ideas.
- Relate creative activities to content and help children acquire a wide fund of information about the topic at hand. Creativity depends on knowledge. One cannot create in a vacuum.
- Beware of forcing creative activities into set patterns and routine methods.
- Develop an atmosphere in the classroom where new ideas are welcomed and rewarded.
- Realize that creativity depends on knowledge and provide the child with opportunities to acquire knowledge in relation to his areas of interest.
- Value the traits of independence in the creative child while at the same time helping him to adjust alienating personality traits such as airs of superiority so that he can function well in the group.
- Give children information about the creative process so they can recognize and promote it in themselves.
- Create curriculums which include creative teaching in all subjects-not just in isolated creative thinking courses.
- Integrate the arts in the general curriculum and encourage children to see the relationship of bodies of knowledge through creation of interdisciplinary courses.
- Provide for affective as well as cognitive development.

- Dispell the awe of masterpieces. Help the child realize the work an artist or inventor put into the perhaps hundreds of attempts to solve his problem before reaching the state of perfection and elegance seen in a masterpiece. Thus, the child will not be discouraged by his own efforts.

- Provide an atmosphere where children feel free to express any thought that comes to them without fear of ridicule or censure.

- Praise and credit growth resulting from the student's own efforts and initiative.

- If we value and praise rote learning and convergent thinking that is what the student will give us.

- Honor the students questions and assist them to find answers for them.

- Provide opportunities for individual search, research and experimentation. Make resources for working out ideas available.

- Encourage the habit of working out the full implications of ideas.

- Develop constructive criticism, not just criticism.

- Encourage acquisition of knowledge in a variety of fields. Knowledge outside and beyond one's field is useful in promoting original ideas.

- Provide an atmosphere of pychological safety and freedom.

- Realize that most high creatives are not wild, bizarre, eccentric persons. This stereotype is based on a rare few. Realize that creative people are more independent in their viewpoint and accept and value this quality.

- Be concerned with the full range of creative talent, not only that of the high IQ child.

A culture fosters creativity to the extent that it encourages openness to internal and external experience, to the extent that its value system includes a positive regard for change and novelty. If the society wants creativity it must nurture and reward it.

BLOCKS TO CREATIVITY

Blocks to creativity occur-

- When an individual feels that his new ideas may be ridiculed.

- When there is little value placed on the individual.

- When emphasis is on quantity, not quality of work.

- When attempts to iron out individual differences are made through standardization.

- When problems are solved by fiat from above.

- When there is little tolerance for individuality.

- When excessive emphasis is placed on convergent thinking and one right answer.

When educators develop a responsible attitude for the development of creative problem solving ability in students they also adopt responsibility for the development of creativity. When this is done some of the major blocks to advances in civiliation such as the closed mind, the fear of failure, fear of being different, negativism desire to cling to the status quo and ridicule of new ideas can be removed. When problems are looked at in a new and fresh light perhaps more of them can be solved. When more people learn how to solve problems creatively the burdens of society can be more widely shared. People will be more self-confident and happy and tend to control their fate rather than being controlled by it.

SOME CURRENT APPROACHES TO THE DEVELOPMENT OF CREATIVITY

A listing of important ongoing programs which attempt to develop creative thinking and problem solving ability are briefly described below as well as some general approaches. References not listed along with each item will be found in the bibliography and materials list.

THE CREATIVE EDUCATION FOUNDATION PROBLEM SOLVING INSTITUTES

The Creative Education Foundation Problem Solving Institutes (headed by Sid Parnes) offer an eclectic program which involves the use of the fundamental principles of the Osborn model; forced relationships, a five-step approach to problem solving; (1) fact finding, (2) problem finding (3) idea finding (4) solution finding, (5) acceptance finding. This is an interactive program created between Synectics, sensitivity training, art, fantasy, meditation, body awareness and other approaches. More about this program can be learned through reading, Guide To Creative Action, Parnes, Noller, Biondi, Scribner, 1977.

SYNECTICS

The Synectics process designed to promote creativity involves two basic processes — "making the strange familiar" and "making the familiar strange". The concept behind it is that the mind compares something new and strange with data previously known and in terms of these data converts the strangeness into familiarity. The basic processes involved are analysis, generalization, and model seeking or analogy. For instance, the structure of the atom (a new idea) when compared to a model of the solar system (a known idea) is better understood.

But novelty also demands a fresh viewpoint, and in problem solving it is often necessary to look at old things, ideas or problems in new ways and from a new viewpoint. This process can trigger creativity. For instance, if the heart is compared to a pump in a swimming pool students can better understand its function in circulating the blood. Thus Synectics is a means of gaining new concepts by relating new and strange things to familiar things. It is also a process of stimulating creativity through looking at familiar things in new ways. Creative innovation depends on breaking metaphorical connections with old facts and feelings and then inventing connections with new facts and feeling. New ways for looking at the old familiar world and metaphors constitute the basis for

triggering new ideas.

Thus Synectics is a means of gaining new concepts by relating new and strange things to familiar things. It is also a process of stimulating creativity through looking at familiar things in new ways. Creative innovation depends on breaking metaphorical connections with old facts and feelings, new ways for looking at the old familiar world, and metaphors constitute the basis for triggering new ideas.

The Synectics method introduced the first explicit scheme for the conscious use of metaphor in creative situations. It identified the three basic metaphorical mechanisms that constitute the basis for creative learning and innovation. They are:

1. Direct analogy - a comparision of one thing with another (e.g. the tyrant time).

2. Personal analogy or symbolic analogy - empathetic identification with something outside oneself (e.g. to swim like a fish, or he is a dynamo).

3. Compressed conflict - a double coupled phrase in which the words fight each other (e.g. captive victor). The use of metaphor can greatly enhance the creative process.

The operational mechanism of Synectics involves evocative questioning that requires an analogical or metaphorical answer. Further information about Synectics may be found in the book Synectics by W Gordon, Harper 1961, and in The Metaphorical Way of Learning and Knowing, also by Gordon, Porpoise Books, Cambridge Mass. 1971, A series of student workbooks which use this process are available from Synectics Educational System 121 Brattle St. Cambridge Mass. 02138.

GENERAL SEMANTICS

General semantics has to do with language, meaning, thinking, communicating and behaving. Creativity is the recombining of known elements into new products. Both areas are basic to man's response to the environment. A knowledge of semantics, signs, symbols, representations, can improve thinking power by enabling the individual to deal with higher levels of abstraction and thus can increase creative problem solving power.

BIONICS

Bionics is the creative process whereby biological prototypes are used in the design of human systems. Relationships are deliberately forced between the principles observed in nature and the needs of humankind. Victor Papaneck has successfully applied the bionic process to industrial design and has used the process with students to promote creative innovation.

SOCIODRAMA AS A PROBLEM SOLVING APPROACH

E. Paul Torrance uses sociodrama as a group creative problem solving process.

BIBLIOGRAPHY

The Creative Process, Brewster Ghiselin (Ed) Mentor: New American Library, N.Y. 1952

Intelligence Creativity and Their Educational Implications, JP Guilford. Knapp Pub., San Diego, California 1968

The Creative Process, Angelo Biondi, The Creative Education Foundation

D.O.K. Publisher Buffalo, N.Y. 1972

A Birds Eye View of Creative Problems Solving, Ruth Noller D.O.K. Publishers Buffalo, N.Y. 1977

Way Beyond the IQ, J.P. Guilford, Creative Education Foundation, Creative Synergistic Association, Great Neck, N.Y. 1977

Have an Affair With Your Mind, Angelo Biondi, Ed., The Creative Education Foundation, Creative Synergetic Assn., Great Neck, NY 1974

Creativity and Intelligence: Explorations With Gifted Students, Getzels and Jackson, NYC McGraw Hill 1967

Applied Imagination, A.F. Osborn, (3rd ed.) Scribners, NYC 1963

A Source Book for Creative Thinking, Parnes and Harding, Scribner, NYC 1962

"Using the Divergent Production Matrix of the Structure of Intellect Model in the Development of Teaching Strategies", Gray and Young in Gifted Child Quarterly, Winter 1975, Vol XIX No. 4, pp. 290 ff.

He uses this method extensively with young students especially in relation to future studies and has written extensively on this topic.

BRAINSTORMING AND IDEA STIMULATION TECHNIQUES

Brainstorming is a method of group problem solving in which ideas are allowed to flow freely. People are encouraged to contribute any idea that comes to mind and no one is allowed to criticize the idea during the brainstorming session. Later the ideas are evaluated. This technique involves the principles of deferred judgment, check lists, forced relationships, attribute listing and the morphological approach. All these techniques are described in detail by Osborn in his book Applied Imagination and Sid Parnes in his publications.

LATERAL THINKING

Most educators concentrate on vertical thinking which is concerned with the development and utilization of ideas. Lateral thinking is concerned with the creation of new ideas. If only vertical thinking is taught, new ideas arise rarely and by chance. Computer technology is now capable of taking over most of the vertical functions of the mind. Lateral thinking deliberately attempts to find new solutions to problems. It is an attempt to improve the performance of the mind through escaping the non creative, logical thinking by using perceptual thinking -the first stage of information processing by the mind in which creativity occurs.

Vertical thinking is sequential. Lateral thinking is more like a visual mosaic. It seeks to break down the established patterns of vertical thinking and regroup them into new and better patterns. Edward De Bono, a British physician has written extensively on this process in his book Lateral Thinking:Step by Step Creativity, Harper Row, 1977.

SCAMPER

In his book of Scamper Games (1972), Robert Eberle encourages the practice of space and functional visualization through simple but powerful exercises. Scamper Games for Imagination Development by Eberle is published by D.O.K. Publishers, Inc. Buffalo, N.Y.

CREATIVE DRAMATICS

Creative dramatics is education of the whole person by experience. It is a technique that can do things no amount of traditional classwork can accomplish. Creative dramatics can teach concepts like faith or trust, stimulate thinking, problem solving and imagination, build confidence in speaking and being oneself in a group.

ART EXPERIENCES

Art education stimulates the right brain, promotes sensitivity to the environment, stimulates imaging power, creativity and knowledge of other symbol systems. Einstein's most important thought was accomplished with visual kinesthetic images, not with words or numbers. Research indicates that children taught to use the image thought processes became more creative and scored highter on intelligence tests. Many other approaches to creativity are suggested in the materials list below.

METHODS, TECHNIQUES, AND EDUCATIONAL PROGRAMS FOR STIMULATING CREATIVITY

This list of methods and programs has been developed for two major purposes: first, to serve as a source of references for further study of particular methods and programs; and second, as an indication of the relationship of a wide variety of methods and programs to the common goals of creative development and expression.

No attempt has been made to provide detailed explanations of any of the methods or programs. Nor is the list intended to be completely comprehensive or critical; certainly, we have not uncovered every possible resource which might have been included. Neither is every item which has been included of equal quality or importance. This compilation attempts to provide merely a representative listing of the great range of available methods, resources, and programs.

1. AESTHETIC EDUCATION PROGRAM

The Central Midwest Regional Educational Laboratory (now CEMREL, Inc.) sponsored an aesthetic education project, in which a multi-media, multi-discipline program was developed for primary through middle school age children. The program, called The Five Sense Store, includes many kits designed to give the child the experience of discovering, using, and understanding h/sr senses and emotions. (For information: Educational Sales Department, The Viking Press, 625 Madison Avenue, New York, N.Y. 10022.)

2. AFFECTIVE DOMAIN

BORTON, T. Reach, touch, and teach. NYC: McGraw-Hill, 1970

KRATHWOHL, D. R., BLOOM, B.S., & MASIA, B.B. Taxonomy of educational objectives, handbook II: the affective domain. NYC: David McKay, 1964

MAGER, R.F. Developing attitude toward learning. Palo Alto, CA: Fearon, 1968

ROGERS, C.R. Freedom to learn. Columbus: Merrill, 1969

ROGERS, C.R. On becoming a person. Boston: Houghton Mifflin, 1961

SPOLIN, V. Improvisation for the theater. Evanston, IL: Northwestern University Press, 1967

WEINSTEIN, G., & FANTINI, M.D. Toward humanistic education: a curriculum of affect. NYC: Praeger, 1970

3. ATTRIBUTE LISTING

FELDHUSEN, J.F., TREFFINGER, D. J., PINE, P. et al. Teaching children how to think. West Lafayette, IN: Purdue Research Foundation, 1975.

PITTMAN, K.L. Morphological analysis and speculation In A.M. Biondi (ed.), Have an affair with your mind Buffalo: D.O.K., 1974.

STEIN, M.I. Stimulating creativity: I. individual procedures NYC: Academic Press, 1974.

4. AWARENESS DEVELOPMENT

FABUN, D. Three roads to awareness. NYC: Macmillan (Glencoe), 1970

5. BIONICS

DAVIS, G.A. Psychology of problem solving: theory and practice. NYC: Basic Books, 1973, chapter 9.

6. BLOCKS TO CREATIVITY

BIONDI, A.M. (ed.). The creative process. Buffalo: D.O.K. 1972

7. BRAINSTORMING

Osborn, A.F. Applied imagination. NYC: Scribners, 1963

8. CANDID CAMERA FILMS

The Cornell Candid Camera Collection, which includes films originally made for and used by the television program, has many delightful short films which illustrate principles of creative problem-solving and effective (as well as not-so-effective) thinking. Write for further information and catalog to: Du Art Film Laboratories, Du Art Film Building, 245 West 55th Street, New York City 10019

9. CHECKLISTS

DAVIS, G.A. Idea checklists for stimulating solutions. In A.M. Biondi(ed), Have an affair with your mind. Buffalo: D. O.K. 1974

10. CLASSROOM TEACHING AND CREATIVITY

SCHAEFER, C.S. Developing creativity in children: an ideabook for teachers. Buffalo: D.O.K., 1973

TORRANCE, E.P. Developing creativity through school experiences. In S.J. Parnes and H. Harding (eds.), A source book for creative thinking, NYC: Scribners 31-47.

TORRANCE, E.P. Encouraging creativity in the classroom, Dubuque, IA: Wm.C. Brown, 1970

TORRANCE, E.P., & MYERS, R. Creative learning and teaching. NYC: Dodd, Mead, 1970.

11. CREATIVE DRAMATICS

McCASLIN, N. Creative dramatics in the classroom. NYC: McKay, 1968

WOODS, M.S., & TRITHART, B. Guidelines to creative dramatics. Buffalo: D.O.K., 1970

12. CREATIVE TEACHING GAMES

HEYMAN, M., Simulation games for the classroom. Bloomington, IN: Phi Delta Kappa Education Foundation, 1975.

KEITH, B. & HALL, S. Teacher-made games: any teacher can. Buffalo: D.O.K., 1974

13. CURRICULUM-GENERAL

DAVIS, G.A., & SCOTT, J.A. (eds.) Training creative thinking. NYC: Holt, Rinehart and Winston, 1971

14. GOWAN, J.C., DEMOS, G.D., & TORRANCE, E.P. (eds.). Creativity: its educational implications. NYC: Wiley, 1967

15. MASSIALAS, B.G., & ZEVIN, J. Creative encounters in the classroom, NYC: Wiley, 1967.

16. CURRICULUM - FINE ARTS

LOWENFELD, V., & BRITTAIN, W. L. Creative and mental growth. NYC: Macmillan, 1975.

17. CURRICULUM-MATHEMATICS

KOHL, H. Math, writing, & games in the open classroom. NYC: New York Review (Random House), 1974

MATTHEWS, G. Nuffield mathematics project. NYC: Wiley. (A British program for ages 5-13.)

18. CURRICULUM-PREPRIMARY

FROSTIG, M. Frostig visual perception program, Chicago: Follett.

KAPLAN, S. N., KAPLAN, J.B., MADSEN, S.K., & GOULD, B. T. A young child experiences. Pacific Palisades, CA: Goodyear, 1975.

KHATENA, J. Training preschool disadvantaged children to think creatively. Huntington, WV: Marshall University, 1969.

SCHAEFER, C. S. Becoming somebody: creative activities for pre-school schildren. Buffalo: D.O.K., 1973.

STENDLER, C. Early childhood curriculum: a Piaget approach. Boston American Science and Engineering..

WOODS, M.S. Wonderwork. Buffalo: D.O.K., 1970. For research on creativity among preprimary children, contact Professor Elizabeth Starkweather, Oklahoma State University, Stillwater..

19. CURRICULUM-READING, LITERATURE, LANGUAGE ARTS

CHRISTENSEN, F.B. Springboards to creative writing, Monterey Park CA: Creative Teaching Press, 1971

DiPEGO, G., & DAVIS, G.A. Imagination express: Saturday subway ride. Buffalo: D.O.K., 1973.

My Weekly Reader: Creative expression series (Imagine and write) Xerox Educational Publishing Co.

Scholastic Magazines: Creative expression series.

SMITH, J.A. Creative teaching of language arts in the elementary school, 2nd ed. Boston: Allyn & Bacon, 1975

20. CURRICULUM-SCIENCE

LaSALLE, D. Write for information concerning an independent science center. Talcott Mountain Science Center. Montevideo Road, Avon, CT 06001.

PILTZ, A., & SUND, R. Creative teaching of science in the elementary school, 2nd ed. Boston: Allyn & Bacon, 1976

SUND, R., TILLERY, B., & TROWBRIDGE, L. Investigate and discover elementary science lessons. Boston: Allyn & Bacon, 1975.

21. CURRICULUM-SOCIAL STUDIES

BRUNER, J.S. Man: a course of study. Curriculum Development Associates, 1211 Connecticut Ave., NW, Washington, D.C. 20036.

EDUCATIONAL RESEARCH COUNCIL OF AMERICA
Concepts and inquiry. (Gr. K-8) Boston: Allyn & Bacon

LIPPITT, R. SOCIAL science laboratory units (Gr. 4-6) Chicago: Science Research Associates.

TABA, H. & DURKIN, M. Taba social studies curriculum (Gr 1-8) Reading, MA: Addison-Wesley, 1979

22. DELPHI TECHNIQUE

Polling procedure resembling an absentee "brainstorming" effort used to generate alternative futures for a particular topic or series of topics. See O. Helmer, Social Technology, NYC: Basic Books, 1966. For additional references, contact Book Service, World Future Society, P.O. Box 19285, Twentieth Street Station, Washington, D.C. 20036.

23. DEVELOPMENTAL STAGE ANALYSIS OF CREATIVITY

DeBONO, E. Think tank: instruction booklet. Toronto, Canada: Think Tank Corp., 1973

WHITING, C.S. Forced relationship techniques. In A.M. Biondi (ed), Have an affair with your mind. Buffalo: D.O.K., 1974

FUTURISTICS

KAHN, H. & WIENER, A. The year 2,000. NYC: Macmillan, 1967

TOFFLER, A. Future shock. NYC: Random House, 1970.

WEBER, R.E. Human potential and the year 2000: the futures project of the New Jersey department of education. Journal of Creative Behaviour, 1973, 7 (2), 133-150.

WEBER, R.E. The techniques of futurology. Journal of Creative Behavior, 1973, 7 (3), 153-160

25. GENERAL SEMANTICS

HAYAKAWA, S.I. Language in thought and action. NYC: Harcourt Brace Jovanovich, 1964

26. IDEABOOKS AND IMAGI/CRAFT SERIES

With his colleagues, Professor E. Paul Torrance of the University of Georgia (Athens, GA 30602) has developed numerous sets and programs for encouraging creative thinking, particularly among elementary school children.

The Ideabooks series, with Robert Myers, includes several booklets: "Can You Imagine?" "For Those Who Wonder "Invitations To Thinking and Doing," "Invitations to Speaking and Writing Creatively," and "Plots, Puzzles, and Ploys".

The Imagi/craft series, with B.F. Cunnington, includes recorded exercises and stories, based on biographical sketches of famous people, and (also with Joe Khatena "Thinking Creatively with Sounds and Words."

For information, write to Ginn and Company, Waltham, MA 02154

36. IMAGINATION GAMES

deMILLE, R. Put your mother on the ceiling: children's imagination games, NYC: Viking, 1973.

EBERLE, R.F. SCAMPER: Games for imagination development. Buffalo: D.O.K. 1971

OTTO, H.A. Fantasy encounter games. NYC: Harper & Row, 1972.
See also R.F. Eberle, "Developing imagination through scamper." Journal of Creative Behavior, 1972, 6, 199-203.

39. LEARNING CENTERS AND INDIVIDUALIZED INSTRUCTION

Many classroom teachers are discovering that classroom space can be used in many ways, and that creativity can flourish when many options are provided for active, participating learning by students. "Learning centers" provide useful ways of organizing such learning in the classroom. Some basic resources include:

ANDERSON, R. Super cards. Monterey Park, CA: Creative Teaching Press, 1974.

COOPERMAN, B., FISCHLE, M.J., & HOCHSTTER, R. Teacher, let me do it: Learning centers that grow. Buffalo: D.O.K., 1975

FORTE, I., PANGLE, M., & TUPA, R. Center stuff for nooks, crannies, and corners. Nashville, TN: Incentive Publications, 1973.

KAPLAN, S., KAPLAN, J., MADSEN, S., & TAYLOR, B. Change for children. Pacific Palisades, CA: Goodyear, 1973

KAPLAN,S.N., & MADSEN, S.K. Think-ins. Monterey Park, CA: Creative Teaching Press, 1974.

MUMMERT, P. Create your own learning centers. Buffalo: D.O.K., 1974

YELLOW PAGES OF LEARNING RESOURCES. Cambridge, MA: MIT Press, 1972.

43. MULTIPLE TALENT TEACHING

Recent psychological advances in the understanding advances of human talents have important implications for educational practice: we must no longer be content to define "talent in an extremely narrow way. Children come to school with many different kinds of talents that must be nurtured and given opportunities for expression.

EBERLE, R. F. Classroom cue cards for multiple talent: teaching. Buffalo: D.O.K., 1974

LLOYD, B., SCHINI, J., & STEVENSON, G. Igniting creative potential: II. Jordan School District, 9361 South 400 East, Sandy, UT 84070 (1974).

44. NEW DIRECTIONS IN CREATIVITY

A program designed to assist teachers of middle-grade youngsters fosters creative thinking abilities. The exercises included in each volume are based on several dimensions of the divergent-thinking category of Guilford's Structure of Intellect model. All exercises are presented as ditto masters than can be duplicated by the user. The volumes in the series are Mark I and Mark II (by Joseph S. Renzulli) and Mark III (by Joseph S. Renzulli and Carolyn Callahan). New Directions in Creativity is published by Harper & Row.

45. PURDUE CREATIVITY TRAINING PROGRAM

The Purdue Creativity Training Program consists of 28 audio tapes and accompanying printed exercises, for the development of creative thinking and problem-solving abilities among elementary school pupils. For further information, write: John F. Feldhusen, Educational Psychology Section, Purdue University, South Campus Courts G, West Lafayette, IN 47907. Published descriptions and research reports,

46. SELF-CONCEPT ENHANCEMENT

FELKER, D.W. Building positive self-concepts. Minneapolis: Burgess Publishing, 1973.

GRIMM, G.D. It's me - you will see Buffalo: D.O.K., 1973

47. SYNECTICS (Or OPERATIONAL CREATIVITY)

A training program that stresses the practical use of analogy and metaphor in problem-solving. The synectics mechanisms "force new ideas and associations up for conscious consideration rather than waiting for them to arise fortuitously." Developed at adult level.

GORDON, W.J.J. Synectics: the development of creative capacity, NYC: Harper Bros. 1961.

MAKING IT STRANGE. Prepared by Synectics, Inc. NYC: Harper & Row, 1968

48. THINK PRODUCTS

A series of materials for teachers and industry to stimulate creative performance. Included is a series of TNT materials for teachers (techniques and tips) and a little magazine called The Creative Thinker. Available from Think Products, 1209 Robin Hood Circle, Towson, MD 21204.

49. THINKING CREATIVELY

Gary A. Davis, Department of Educational Psychology, University of Wisconsin, Madison, has been active in research on the development of creative thinking abilities, and in constructing instructional programs and materials as well. He has also published with Joseph A. Scott, an anthology entitled, Training Creative Thinking. NYC: Holt, Rinehart, and Winston, 1971.

DAVIS, G. A. Psychology of problem-solving: theory and practice, NYC: Basic Books, 1973.

50. VERBAL IMAGERY

Research on the facilitation of verbal imagery and imagination has been conducted by Professor Joe Khatena, of Marshall University in Huntington, West Virginia.

KHATENA, J., & TORRANCE, E.P. Thinking creatively with sounds and words: norms and technical manual Lexington, MA: Personnel Press, 1973.

TORRANCE, E. P. KHATENA, J., & CUNNINGTON, B.F. Thinking creatively with sounds and words. Lexington, MA: Personnel Press, 1973

51. WFF'N PROOF

A symbolic logic game designed to increase one's ability to discover new relationships in a logical manner. Portions applicable at elementary level, proceeding through adult levels. Available from author, L.E. Allen (WFF'N PROOF, the game of modern logic), P.O. Box 71, New Haven, CT 06501.

52. WILLIAMS' MODEL

Frank W. Williams has developed an approach for helping teachers integrate the teaching of cognitive and affective skill with the presentation of subject matter. Other published reports include:

WILLIAMS, F.E. A total creativity program for individualizing and humanizing the learning process. Englewood Cliffs, NJ: Educational Technology Press, 1972.

WILLIAMS, F.E. Classroon ideas for encouraging thinking and feeling. Buffalo: D.O.K., 1972